

a plant stem will freeze as fast as it appears at or just beneath the surface of the stem. Roots are apparently little, if any, involved in this process, for stems that are carefully cut and replaced in the ground will produce ribbons. Passage of the water up through and across the stem is probably by way of the vascular tissues, but whether the death of the stem has enlarged or altered these passages so as to permit a freer flow of water is unknown. Ribbons may be produced on successive nights from the same stem, raising as much as 60 cc of water each night. The flow of water radially across the stem apparently takes place along the medullary rays, and the ice ribbons begin as thin crystals at the ends of these rays beneath the surface of the stem. The species of plants that habitually produce ice ribbons should be examined to see whether their medullary rays resemble one another closely.

Salt ribbons and ice ribbons thus seem to have much in common mechanically in their development. The ice crystals or pillars surmounted by particles of earth or rock, seen frequently in open ground during mild, alternately thawing and freezing winter weather, are coarser structures, but evidently develop in somewhat the same manner as ice ribbons from the stems of plants, namely, by the freezing of water as fast as it rises from pores in the ground. In

quite a different category from ice ribbons belong ice stalactites, stalagmites, and foam "volcanoes," described by H. J. Schaefer (1944). The latter resemble geyser cones in outline and appearance, but are fragile structures formed by the freezing, under proper atmospheric conditions, of foam pushed up slowly but continuously through holes in ice below waterfalls.

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ENTOMOLOGY.—*Synoptic revision of the United States scarab beetles of the subfamily Dynastinae, No. 2: Tribe Oryctini (part).*¹ LAWRENCE W. SAYLOR, Research Associate, California Academy of Sciences.

This paper continues the series on United States dynastine scarab beetles and includes the three genera differentiated in the following key:

1. Apical margin of posterior tibia evenly truncate, never with angulations or teeth (lateral view); real apex of clypeus *beyond* (i.e., apical of) the apparent carinate apex; front male tibia frequently edentate.

Cheiroplatys Hope

Apical margin of posterior tibia never evenly truncate, always with several angulations, or teeth; apical carina of clypeus, *if* present, right *at* the apical margin. 2

2. Mandibles always large, always well exposed, always armed externally with teeth or else square in outline (*cessus*); apical margin of posterior tibia usually with 1 or 2 sharp angulations or 1 to 3 or 4 teeth.

Strategus Hope

Mandibles usually hidden beneath clypeus, or only edges exposed, and always unarmed externally; usually with 5 to 9 small to large teeth on outer apical margin of posterior tibia. *Xyloryctes* Hope

Genus *Cheiroplatys* Hope

Cheiroplatys Hope, 1837, p. 84; Lacordaire, 1856, p. 411; Arrow, 1937b, p. 37.
Orizabus Fairmaire, 1878, p. 260; Bates, 1888, p. 320; Casey, 1915, p. 222.

¹ Received September 27, 1945.

Pseudaphonus Casey, 1915, p. 210; Arrow, 1937b, p. 35.

Aztecilius Casey, 1915, p. 228.

Arrow lists 32 species in this genus in his 1937 Catalogue; many of these are synonyms and are here listed as such, and additional ones from our faunas will probably prove to be synonymous. This genus is one of those that occur apparently only in the American and Australian regions, and the majority of the species are from New Guinea and Australian localities. There is a great deal of variation in the thoracic armature (presence or absence of a tubercle and strong fovea) as well as in the height and width of the one or two head carinae, which may be much worn in numerous individuals, thus giving them a superficially different appearance; such is also true of the front tibia, which normally in the male of some species, and infrequently also in the female, may be nontoothed externally, but broadly rounded or uni- to bisinuate.

KEY TO UNITED STATES CHEIROPLATYS

1. Size very large (21–24 mm); pygidial puncturation variable, from nearly smooth to densely subrugosely punctate, but most commonly the center disc finely and not densely punctate; male front tibia usually rounded externally and not toothed; clypeal apex with short carina, which is usually interrupted at middle and obtusely bidentate, rarely nearly entire; clypeal base with a small to large tubercle, this rarely semicarinate but then the hardly obvious carina obsolete at sides; center-apex of thorax deeply foveate and tuberculate, or entirely plane (*i.e.*, either evenly convex or flat) *clunalis* (LeConte)
Size much smaller (14–18 mm); clypeal carinae variable, not as above; thorax only rarely foveate or tuberculate. 2
2. Clypeus strongly narrowed in front, apical carina much shorter than half the length of clypeus at base, and strongly elevated and usually narrowly interrupted at middle, thus appearing bidentate; front with a large tubercle, this sometimes a little finely carinate to each side, but never with a strong raised carina; pygidium always very densely and finely cribrate punctate over entire disc, rarely a little sparser at center.
pyriformis (LeConte)
Clypeus very broad in front, apical carina much more than half the length of the posterior carina and always raised, entire and straight; thorax in males usually foveate at midapex and tuberculate or not, usually plane in females; pygidial sculpture cribrate and close at sides, most specimens with small

to large midcenter discal area smooth, or with finely sparsely punctate area.

isodonoides (Fairmaire)

Cheiroplatys clunalis (LeConte)

Aphonus (?) *clunalis* LeConte, 1856, p. 23; Bates, 1888, p. 321.

Cheiroplatys verticalis Fall, 1905, p. 272. (New synonymy.)

Orizabus clunalis (LeConte), Casey, 1915, p. 226.

Orizabus ligyrodes Horn, 1885, p. 125.

O. sallei Fairmaire, 1878, p. 262.

O. marginatus Fairmaire, 1878, p. 262. (New synonymy.)

O. cultripes Fairmaire, 1878, p. 261. (New synonymy.)

O. frontalis Casey, 1915, p. 226. (New synonymy.)

O. ponderosae Casey, 1915, p. 228. (New synonymy.)

O. parvitaris Casey, 1915, p. 227. (New synonymy.)

O. snowi Horn, 1885, p. 124. (New synonymy.)

It is easy to see why so many names have been proposed for our United States *clunalis* when one considers the great amount of variability here in the width between the clypeal teeth; the pygidial puncturation; and the presence or absence of, as well as the depth of, the front thoracic concavity. In some specimens the "apical" clypeal transverse carina (which forms the two lateral teeth) is much reduced at the middle, leaving the two ends as rather large isolated teeth; in others the carina is much less reduced medially and the teeth are smaller and much closer together. Some females have the thoracic concavity entirely lacking and the midcenter apex reduced to the faintest tubercle, while others are plane; in fact, in one series from New Mexico (58 specimens), 22 totally lacked the thoracic fovea and of these 22 seven also lacked all traces of a tubercle, giving some idea of the variability of these characters. In several dissected females (including Casey's type of *parvitaris*) the front tibia are edentate as in most males. Two male examples from Arizona have the clypeal apex much narrower than usual and the two apical teeth so close as to be touching basally, and more reflexed than usual; in all other external characters as well as the genitalia, however, they are typical *clunalis*. I have seen very large series from Texas, New Mexico, Arizona, and Mexico (Hidalgo and Pachuco); also recorded from many other Mexican localities under the names of the synonyms.

Bates separated *cultripes* from *clunalis* only on the nonmargined thoracic base; a Mexican series from Temascaltepec, D. F. (Hinton collector), is equally divided between specimens having the thoracic base margined and not margined, with all intermediates, and as Bates suspected at the time of describing *cultripes* it cannot be separated from *clunalis*.

Cheiroplatys pyriformis (LeConte)

Bothynus pyriformis LeConte, 1848, p. 21; Casey, 1915, p. 211 (*Pseudaphonus*); Ritcher, 1944, p. 28 (*Pseudaphonus*) (larvae).

Pseudaphonus ovalis Casey, 1915, p. 212.

P. repens Casey, 1915, p. 212.

P. debiliceps Casey, 1915, p. 213.

P. lucidus Casey, 1915, p. 213.

P. puncticollis Casey, 1915, p. 335.

This species is found rather uncommonly in the Southwest; I have seen it from Colorado and New Mexico only. The variable characters are mentioned in the species key. The male genitalia are nearly exactly similar in shape to *isodonoides*, and it is possible that when larger series are studied the two species may prove to be variants of one species.

Cheiroplatys isodonoides (Fairmaire)

Orizabus isodonoides Fairmaire, 1878, p. 263; Bates, 1888, p. 322 (*Cheiroplatys*); Casey, 1915, p. 228 (*Aztecalius*).

I have seen good series from Mexico and one female from Colorado which I cannot separate from Mexican females of this species. The two large and entire clypeal carinae are very distinctive.

Cheiroplatys brevicollis (Prell)

Orizabus brevicollis Prell, 1914, p. 204.

Prell described this species on three male specimens from "California (W. Horn) and Mexico"; the species was compared to the Mexican *fairmairei* Bates and varied in size from 20 to 22 mm, and so on size it could be confused only with *clunalis*, from which the male genitalic figures will readily separate it. I doubt that the species occurs in the United States but believe that the locality "California" refers to Baja California.

Genus Strategus Hope

Strategus Hope, 1837, p. 87; Casey, 1915, p. 238; Arrow, 1937b, p. 35; Ritcher, 1944, pp. 34-38 (larvae).

Anastrategus Casey, 1915, p. 231; Arrow, 1937b, p. 35.

Strategodes Casey, 1915, p. 245.

Strategopsis Chapin, 1932, p. 302.

Scatophilus Chapin, 1932, p. 302.

This American genus is catalogued at 32 species at present and is limited to the West Indies and the American continents. Five species occur in the United States. Various genera or subgenera have been proposed, and to one unfamiliar with the many species in the genus these may seem valid; this is especially true of those species in which both sexes have the thorax and head entirely unarmed (*cessus* etc.) as opposed to those where the male is usually strongly armed. Also, *mormon* appears to be quite distinct in the elongated mandibular tooth as well as the frequently unarmed male head and thorax, but all intermediates occur so that these names do not stand up. Also, as Arrow has rightly pointed out (1937b), genera based on characters entirely sexual are of no value, since the purpose of taxonomy is to rightly place all specimens that may come to hand, and if it is impossible to place the females of many species unless associated with the males, then such genera are obviously of no value whatever.

The larvae feed on decaying vegetable matter in soil rich in humus, as well as in rotten wood, and on roots of oak and other trees; detailed life history and larval character references, where known, are listed under the individual species.

KEY TO UNITED STATES STRATEGUS

(Last abdominal sternite of males widely transversely emarginate one-half or one-third before the apical margin, the line of emargination with long erect cilia; females with last ventral plane, ciliate at apex.)

1. Middle mandibular tooth very long and narrow, nearly twice as long as the others and very sharp and suddenly narrowed for the last half of its length; color always rufo-castaneous; male with short horn on fore thoracic margin and two faint, widely separated tubercles at midapex; female thorax tuberculate before midapex; Kansas, Utah, Texas..... *mormon* Burmeister
Mandibles variable, never suddenly narrowed at middle or very long and narrow..... 2
2. Thorax never with any suggestion of horns in either sex, midapex with two small nearly contiguous tubercles; mandibles from above nearly square, in some specimens with a faint sinuation to apical and lateral edge;

- color normally piceocastaneous; Arizona and New Mexico.....*cessus* LeConte
Thorax horned or not, or midapex either plane or with one erect tubercle or small horn; mandibles not as above.....3
3. Thorax with small tubercle at midapex; thoracic disc without further horns in either sex; mandibles with middle tooth much broader and larger than others but very obtuse; color normally rufous to rufocastaneous, rarely rufopiceous; female pygidial apex before and each side of apex entirely impunctate and smooth; size 25-28 mm; North Carolina and Florida.....*splendens* Beauvois
Thorax and mandibles not as above or if somewhat similar (female) the size either larger or pygidium before apex and at each side of apex coarsely setiferously punctate.....4
4. Size small (24-32 mm); males with the three thoracic horns normally long and of nearly equal width near base and throughout; in male minors the horns sometimes short but always rather narrow at base, and disc at center base punctured and smooth, never coarsely cribrate; females with thoracic armature as in *julianus* but thorax noticeably flatter and base never coarsely cribrate before the margin, at most with a few or a single line of coarse punctures; East States to Florida and west to Texas.

antaeus (Drury)

Size large (37-46 mm); males with horn arising from midapical thoracic margin very short to very long, and each side of thoracic disc before middle varying from two large and well-separated gibbosities to two long horns; if horned, these always much wider basally than apical horn; base thorax coarsely cribrate each side of middle base; females with a small preapical tubercle at middle thorax, and without the posterior gibbosities; thorax just before basal margin on each side of middle very coarsely cribrate; Mississippi and West to Texas and Arizona, to Central and South America.

julianus Burmeister

Strategus julianus Burmeister

- Strategus julianus* Burmeister, 1847, p. 133; Casey, 1915, p. 242; Nevermann, 1933, p. 181; Ritcher, 1944, p. 35 (larvae).
S. gaillardi Casey, 1915, p. 244.
S. roosevelti Casey, 1915, p. 241.
S. arizonicus Schaeffer, 1915, p. 47; Casey, 1915, p. 252.
S. tarsalis Casey, 1915, p. 243. (New synonymy.)

The adults of this common and very wide-ranging species are commonly attracted to light; ranges from Mississippi west and through Central and South America. Casey's *tarsalis* was separated by him because the apex of the hind tibia of the unique female type lacked

the usual center tooth, but in a female from northern Mexico the left tibia is as Casey described, but the right tibia has the usual small tooth, and specimens from other localities approach it; the tooth is readily worn in specimens that dig a lot.

Strategus mormon Burmeister

- Strategus mormon* Burmeister, 1847, p. 130; Knaus, 1924, p. 142; Knaus, 1916, p. 79 (biology); Casey, 1915, p. 251 (*Strategodes*).

The unusually long and slender middle mandibular tooth is very distinctive; the species is rather uncommon in most collections because of its somewhat restricted distribution, being known from Kansas, Utah, and Texas.

Strategus splendens Beauvois

- Strategus splendens* Beauvois, 1805, p. 89; Ritcher, 1944, p. 37 (larvae); Casey, 1915, p. 237 (*Anastrategus*).
S. bosci Beauvois, 1805, p. 89.
Anastrategus carolinensis Casey, 1915, p. 237.
A. cognatus Casey, 1915, p. 236.

A rather uncommon species known from North Carolina to Florida. As with *cessus*, the two sexes here are similar in thoracic sculpturing.

Strategus cessus LeConte

- Strategus cessus* LeConte, 1866, p. 382; Casey, 1915, p. 233 (*Anastrategus*).
Anastrategus durangoensis Casey, 1915, p. 234.
A. inflatus Casey, 1915, p. 234.
A. tantalus Casey, 1915, p. 235.
A. cavicauda Casey, 1915, p. 233.

Recorded and seen only from Arizona, New Mexico, and northern Mexico. The thorax is unarmed in both sexes and the nearly or quite square mandibles (dorsal view) are very characteristic in fresh specimens, before they have worn the mandibular margins through digging. Small females are easily separated from female *Aphonides dunnianus* by having the thorax foveate, the mandibles not rounded externally, and the basal clypeal carina not entire.

Strategus antaeus (Drury)

- Scarabaeus antaeus* Drury, 1773, p. 74; Arrow, 1937b, p. 37 (*Strategus*); Forbes, 1906, p. 34 (biology); Manee, 1908, p. 286 (biology); Ritcher, 1944, p. 34 (larvae); Casey, 1915, p. 234 (*Strategus*).
Scarabaeus maimon Fabricius, 1775, p. 10.
Strategus syphax Burmeister, 1847, p. 131.

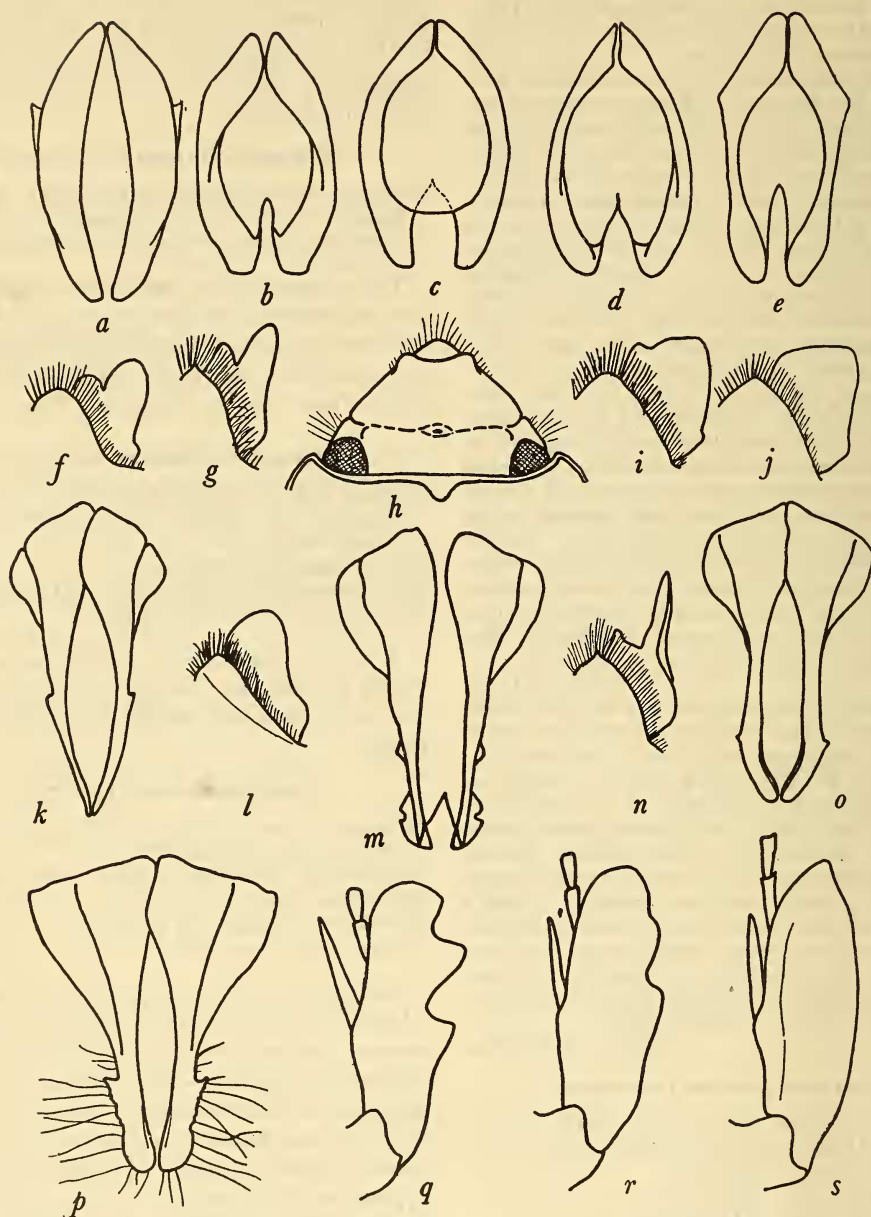


FIG. 1.—(f-g, i-j, l, n, dorsal views of mandible; h, head of male; q-s, front male tibia; remainder are male genitalia.) a, *Strategus julianus*; b, *S. mormon*; c, *S. splendens*; d, *S. antaeus*; e, *S. cessus*; f, *S. splendens*; g, *S. antaeus*; h, *Cheiropatys clunalis*; i, *S. cessus*; j, *S. cessus*; k, *C. isodonoides*; l, *S. julianus*; m, *C. brevicollis*; n, *S. mormon*; o, *C. clunalis*; p, *Xyloryctes jamaicensis*; q, *C. pyriformis*; r, *C. isodonoides*; s, *C. clunalis*.

- S. houstensis* Knaus, 1925, p. 182.
Strategodes atrolucens Casey, 1915, p. 247.
Strategodes pinorum Casey, 1915, p. 248.
Strategodes septentrionis Casey, 1915, p. 249.
Strategodes divergens Casey, 1915, p. 246.
Strategodes sinuatus Casey, 1915, p. 250.
Strategodes semistriatus Casey, 1915, p. 250.

This is the commonest, most variable, and widest spread of the United States species, occurring from Rhode Island to Florida, west to Texas.

Genus *Xyloryctes* Hope

- Xyloryctes* Hope, 1837, p. 90; Bates, 1888, p. 323; Casey, 1915, p. 252; Ritcher, 1944, p. 38 (larvae).

Fifteen species of this genus have been described, two of them West Indian in distribution, eight purely Central America, and the remaining eight names all applying to the common and very variable United States species called *jamaicensis* Drury.

Xyloryctes jamaicensis (Drury)

- Scarabaeus jamaicensis* Drury, 1773, p. 74; Bates, 1888, p. 323 (*Xyloryctes*); Casey, 1915, p. 254 (*Xyloryctes*).
S. satyrus Fabricius, 1775, p. 12; Bates, 1888, p. 323; Hamilton and Hagen, 1884, p. 107, p. 239 (as *Xyloryctes*) (biology); Weiss, 1921, p. 193 (as *Xyloryctes*) (biology); Ritcher, 1944, p. 38 (as *Xyloryctes*) (larvae).
S. americanus Beauvois, 1805, p. 75.
Xyloryctes faunus Casey, 1895, p. 609; 1915, p. 256. (New synonymy.)
X. hebes Casey, 1915, p. 257. (New synonymy.)
X. lacustris Casey, 1915, p. 255. (New synonymy.)
X. tenuicornutus Casey, 1915, p. 255. (New synonymy.)
X. obsolescens Casey, 1915, p. 256. (New synonymy.)

Ranges throughout the Eastern States and West to Arizona and Texas. The Arizona specimens are very close to the common Mexican *thestalus* Bates in that the male genitalia are identical and the central thoracic lobe is more protuberant than in the Eastern United States specimens, and the species are separable only on the much smoother elytral sculpture of *thestalus*, which must be listed as only a subspecies of the earlier-described *jamaicensis*. Much confusion has existed as to the proper name for this species, and Bates and others refused to accept the earlier name *jamaicensis*, but rules of priority demand its adoption, even though it is inappropriate owing to the species

being much more common in the United States than in Jamaica. Most of Casey's types are male minors; nearly all the eastern examples have the male central thoracic lobe obsolete or nearly so, whereas the western ones usually have this lobe obvious to moderate in size. It varies greatly in size, ranging from 21 to 33 mm in length.

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